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ABSTRACT

Research has offered evidence that teacher candidates are continually frustrated by a perceived conflict between the ideas expressed in methods course and the practices they see in classrooms where they carry out their observations and practicums. The hypermedia tool Reading Classroom Explorer (RCE) was developed in response to this problem. Though RCE is beneficial, the program's efficacy was constrained by its format. Capitalizing on recent advances in video streaming on the Web, a new iteration of RCE was developed--one that allowed interaction among teacher candidates who were learning about the teaching of literacy. The purpose of this study is to explore how a more conversation-friendly technology would scaffold teacher learning. This paper provides evidence of the benefits of such conversation, by presenting findings on the increase in students' understanding of teaching and learning after using the RCE. It also describes the move from a CD-ROM to a Web-based product, and the benefits and requirements of doing so. The paper concludes with a discussion of RCE's implications for research on pre-service teaching and educational technology, and raises additional questions about how conversations can be sustained and supported with technology. (Contains 2 tables of data and 36 references.) (PM)

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Building Electronic Discussion Forums to Scaffold Pre-Service Teacher Learning: Online Conversations in the Reading Classroom Explorer

CIERA REPORT #3-021

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CIERA Inquiry 3: Policy and Profession
How do web-based learning environments enhance preservice literacy methodology classrooms?

Research has offered evidence that teacher candidates are continually frustrated by a perceived conflict between the ideas expressed in methods courses and the practices they see in the classrooms where they carry out their observations and practicums. The hypermedia tool Reading Classroom Explorer (RCE) was developed in response to this problem. RCE provides models of teaching excellence to pre-service teachers through video clips on CD-ROM.

Our studies of students who were using the RCE CD-ROM indicated that these video-based portrayals of challenging pedagogical practice were encouraging and vital to pre-service teachers, providing new and varied learning opportunities, as well as multiple perspectives on the teaching of culturally and intellectually diverse students.

Although we knew RCE to be beneficial, the program's efficacy was constrained by its format. Participant feedback, as well as theoretical and empirical work highlighting the value of discourse and conversation, challenged the tool's limits. Capitalizing on recent advances in video streaming on the Web, a new iteration of RCE was developed—one that allowed interaction among teacher candidates' who were learning about the teaching of literacy.

The purpose of our study was to explore how a more conversation-friendly

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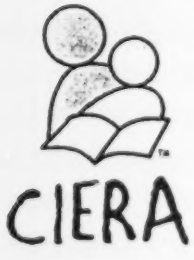

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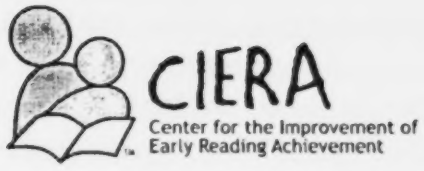

technology would scaffold teacher learning. This paper provides evidence of the benefits of such conversation, by presenting our findings on the increase in students' understandings of teaching and learning after using RCE. The article also describes the move from a CD-ROM to a Web-based product, and the benefits and requirements of doing so. The paper concludes with a discussion of RCE's implications for research on pre-service teaching and educational technology, and raises additional questions about how conversations can be sustained and supported with technology.

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Building Electronic Discussion Forums to Scaffold Pre-Service Teacher Learning: Online Conversations in the Reading Classroom Explorer

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Teacher candidates sometimes report frustration with the tension between their field experiences in elementary classrooms and the reform-oriented instructional techniques that they often learn about in their methods courses (Hughes, Packard, & Pearson, 1998a). They also express concern about the conventional pedagogy of methods classes which are "limited to articles, books and lectures about methods of teaching reading and writing" (Ferdig, Hughes, Packard, & Pearson, 1998), and feel the need to see models of challenging, reform-oriented teaching in action (Ferdig et al., 1998; Hughes, Packard, & Pearson, in press). Even classroom observations and internship experiences can fail to provide teacher candidates with desirable teaching and learning experiences. Some candidates do not have the opportunity to observe classes in their subject matter of interest; others work at field sites whose teaching aligns with the pedagogical and theoretical focus of the student's university program; and still others are so busy "helping" the teachers the observe (e.g., by grading papers or managing groups) that they have few opportunities to "watch" pedagogy in action.

Even when they do have access to high-quality models, teacher candidates do not necessarily possess the tools that are necessary to transform their observations and training into deep reflection and action (see Dunkin, Precians, & Nettle, 1993; Feiman-Nemser & Buchman, 1986; Goodman & Fish, 1997; Hughes et al., 1999). Involvement in a practicum or apprenticeship does not guarantee access to "truly meaningful experiences" (Kinzer & Risko, 1998), nor does it guarantee access to diverse approaches to language and literacy instruction or (intellectually, ethnically, or culturally) diverse student perspectives. Even if a university instructor is blessed or gifted enough

to secure rich field experiences for their students, many teacher candidates do not know how to take advantage of such situations.

These concerns led us to develop the hypermedia-based Reading Classroom Explorer (RCE), which is designed to provide multiple opportunities for teacher candidates to develop rich understandings about teaching and learning in classrooms where diversity of pedagogical approaches and student populations are evident. While we have already learned much about the value of RCE as a pedagogical tool, the role of electronic collaboration and conversation in learning about literacy instruction is yet unexplored. The purpose of this study is to investigate the impact of electronic conversations on the literacy learning of teacher candidates using RCE.

Some Background About RCE

The Reading Classroom Explorer[1] contains many features that are designed to facilitate student learning, including over 200 video excerpts from the Center for the Study of Reading's "Teaching Reading: Strategies from Successful Classrooms" videotape series (documenting six diverse classrooms) and three newly-developed video cases which expand on that series. These clips are accompanied by video transcripts, questions for further reflection, and reference citations for further research. The Reading Classroom Explorer also includes an interactive notebook, a forum for discussing responses to clips, and a site where students can publish papers in response to RCE activities. Although we could already use videotape to transport students into model classrooms to see diversity in action, we also wanted to enable them to visit, revisit, analyze, critique, compare, and contrast diverse classrooms. Hypermedia allowed us to accomplish this in a rich, flexible, and idiosyncratic manner. Elements from diverse classrooms are combined, in a medium over which the user has a significant amount of control. With RCE, users are able to watch video clips, read transcripts, and keep track of their responses and reflections in an interactive notebook. At each step of this learning process, users are provided with opportunities to ask questions, share thoughts, and interact with other users in RCE's discussion forum.

RCE allows pre-service teachers to more deeply understand the teaching of reading and writing by examining context, teachers' goals, and students' reactions. It brings the "real" classroom into the university, scaffolding the novice by providing them with feedback from classroom teachers, and access to other students' reactions to the shared video material. In other words, the development of RCE is an attempt to provide teacher candidates with exposure to diverse teaching environments, while helping them develop the tools they need to analyze and understand the material that they are observing. Our hope is that this environment will broaden teacher candidates' understanding of the teaching of reading, and expand the repertoire of experiences from which they can form their own teaching philosophy.

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1. The Reading Classroom Explorer is available on the World Wide Web at http://www.eliteracy.org/rce

Theoretical Bases

Although much has already been written about RCE's theoretical underpinnings (Ferdig et al., 1998; Hughes et al., 1997; Hughes et al., 1998a; Hughes et al., 1999), three main points need to be highlighted. First, we understand that teaching, and thus helping, teacher candidates to understand teaching is a very complex and ill-structured process (Spiro, Coulson, Feltovich, & Anderson, 1988). RCE's hypermedia environment has been designed to provide an "optimal user-directed exploration of teaching reading in culturally sensitive ways in a manner that is clearly consistent with the 'multidimensional landscape exploration' of the Cognitive Flexibility Theory" (Hughes, Packard, & Pearson, 1998b).

Second, the process of learning, as it exists in complex domains like teacher education, prompts a call for more case-based instruction. Hypermedia environments provide one way of responding to this call for vivid, explicit cases. Hughes and colleagues (1999), summarizing the research on use of hypermedia cases in teacher education, found that the inclusion of video resources in teacher preparation programs "provided a context-rich anchor from which students and instructors drew examples and explications, asked more higher level questions, became more flexible in their analysis and application of teaching methods, used [the video clips] as models for teaching, and retained more vivid recollections of the video content" (Hughes et al., 1999; see also Bransford, Kinzer, Risko, Rowe, & Vye, 1989; Kinzer & Risko, 1998).

The Reading Classroom Explorer is also based in part on research into case-based teaching and complex domains. It is, of course, possible to deliver cases that examine literacy instruction *without* resorting to multimedia. However, research indicates that students who work in multimedia environments generate higher-level questions than students working in classes without multimedia (Risko, Yount, & McAllister, 1992). Furthermore, although research specifically focusing on RCE and practicum experiences is still underway, general indicators show that "students in these [multimedia] classes refer to the cases to guide their teaching in practicum settings" (Kinzer & Risko, 1998; see also Risko, 1995; Risko, Peter, & McAllister, 1996). Thus, the cognitively flexible hypermedia environment allows teacher candidates to view and re-view cases at different times, with different questions, and in different (educational and professional) contexts. This variety, in turn, scaffolds their learning and their appreciation of pedagogical diversity, while supporting their teaching during the internship years.

From CD-ROM to the Web

Earlier research (Hughes et al., 1998a) has revealed that RCE can help teacher candidates learn about a variety of teaching methods, and can scaffold their understanding of the adaptability and flexibility they will need to support student success. The CD-ROM version of RCE has proven to be a successful teaching tool that stimulates "higher order thinking and guides it

in a way that makes learners better at more independent thinking" (Salomon, 1993). It is a technology that encourages student teachers to traverse the complex domain of learning, and provides guidance through multimedia-rich cases of teaching. Our past case studies have demonstrated that the CD-ROM version of RCE stimulates teacher candidates' higher-order thinking in pre-service classes. Current research is attempting to explore how these visual models of diverse ways of teaching literacy provide the tools that lead to better and more independent thinking by teachers.

Although the CD-ROM version of RCE has been clearly successful, certain practical limitations became evident early on. For one, the CD-ROM is based on the SuperCard program, which is only available for the Macintosh operating system: as a result, RCE users were required to work to the Macintosh platform. The space limitations of the CD-ROM medium were also painfully apparent. When we decided to increase the amount of footage available to RCE users, we were faced with a decision about which clips had to be cut in order to fit RCE onto a single CD. Finally, anyone who wanted to use the system had to have a CD-ROM.

We were also faced with a more theoretical problem. We found that teachers used the CD-ROM notebook (a simple notepad tool for saving comments and questions) as a medium in which they could have their students write papers about the video clips and the various questions that had emerged. However, the opportunities for collaboration were limited, available mainly to those few students who worked either together or in close enough proximity that they could share ideas. For instance, some classroom assignments required students to work together on the same computer, either at the teacher's behest or because of the limited availability of equipment. At most, collaboration in this context meant that the teacher would have students share their completed papers (notebooks) at the end of the semester.

These limitations—platform constraints, access, updating, and the theoretical idea of collaboration—motivated us to increase the number of users and expand the variety of possible interactions. We had created a product that allowed teacher candidates to construct notions of teaching and learning individually, but which provided few opportunities to interact with other users of RCE. The CD-ROM version of RCE did not promote social learning across time and space.

The desire to promote social interactions arose from two main sources. First was multimedia's potential, as evidenced in research, to maximize social interaction in pre-service learning environments (Kinzer & Risko, 1998). Second was the sociocultural perspective, that through the establishment of accepted discourse, a history of experience, and shared purpose (Vygotsky, 1978; Rogoff, 1995; Wertsch, 1991), verbal interaction (Schegloff, 1991) mediates the advancement of individuals' thinking, as well as the development of community. Vygotsky (1978) theorized that word meaning, or more broadly, the dynamic of meaning-making, develops through the social process of language use over time. In other words, our teacher candidates benefited greatly from being able to view and review images of literacy teaching to diverse populations. However, they were not guaranteed access to the semiotic mediation (via language, vocabulary, and talk) that they needed in order to internalize those models into their own conceptions of teaching and learning.

This second strand of research is grounded in discourse analysis (see Cazden, 1988; Tannen, 1989). Erickson and Shultz argue that social interaction creates contexts for the partners in discourse (Erickson & Shultz, 1977). One might even argue that conversation (in forms such as storytelling) is one way in which we create the worlds and selves which we inhabit (Bradt, 1997; Cheyne & Tarulli, 1996; Hardy, 1977; Kotre, 1995; White, 1990). However, our point is not to argue the extent to which conversation impacts learning. It was plainly evident to us that conversation was an important element in the scaffolding of teacher candidates as they began to think and talk about themselves as teachers.

Our theoretical and pragmatic concerns, as well as our desire to make the tool more social, led us to move RCE to the Web. We knew that RCE was a viable tool for teacher development, but we also suspected that an Internet-based version could afford even more opportunities for scaffolding, including: a) an ever-expanding set of teacher cases (information storage capacities are much greater on the Web than on CD-ROM); b) an wider user group (freed from reliance on CD-ROMs or specific operating systems); and c) interactive, social, and collaborative tools that can help teacher candidates internalize conceptions and models of literacy instruction.

The first enhanced feature of a Web-based RCE is a more functional notebook. In the Web version, all users can share their notebooks, which contain responses to specific clips, answers to RCE-provided questions, and anything else they might want to share. A second important element in the Web version is an RCE paper-writing and submission site. Using their notes from viewing movies, teacher candidates can summarize and synthesize their thoughts into papers. Any paper can then be shared with an instructor (who can read the paper on-line), with other teacher candidates, and with RCE users worldwide (with the author's permission). The third new addition to RCE is a discussion forum. A student who wants more information, is puzzled by certain clips, or just wants to share ideas can post puzzlements or comments to a user discussion forum.

Method

Stemming from our presupposition that language and discourse affect the ways in which students think about teaching and learning, we decided to investigate the impact of the discussion forum on a pre-service class. We wanted to understand the paths of teacher candidates' thinking as they engaged in sustained, meaningful conversations about instruction over time. Our inquiry revolved around the question of what constituted productive learning conversations during interactive, electronic language dialogues.

Participants

This study was conducted with 32 teacher candidates during the fall semester of a year-long series of methods courses. All participants had completed

an introductory class on learning and were now involved in a reading methods course that required them to work with small groups of elementary students two mornings a week. Teacher candidates were placed in these classrooms in pairs, in order to further develop their understanding of literacy teaching and learning. After the participants had completed the set of courses and field experiences, they finished their teacher preparation program with a yearlong internship.

The Context

The reading course was designed as a learning community, in which dispositions such as sensitivity, responsibility, risk taking, trustworthiness, and allowing others the freedom to differ were presented, modeled, discussed, and applied. Ongoing reflection occurred in many ways. All participants were both learners and teachers during a wide range of learning opportunities in both the university and elementary school classrooms. Several of Vygotsky's constructs were employed within this learning community, including: opportunities for the teacher candidates to internalize concepts of literacy instruction through written and oral conversation (Vygotsky, 1981); the development of learning within the candidates' zones of proximal development (Vygotsky, 1987); the organic metaphor of development, wherein learners in the interpsychological stage are likened to maturing buds, and those in the intrapsychological stage to mature fruits of understanding (Vygotsky, 1985); and planned movement from collaborative learning in the early stages to independent learning during the final phases (Vygotsky, 1987). Teacher candidates were also provided with opportunities to develop "intersubjective" understandings with their colleagues, during tasks which were designed to increase their expertise in literacy teaching and learning (Rogoff, 1990), with scaffolding provided as needed (Bruner, 1985). Reflection was also used to enhance candidates' awareness of their learning. Finally, the concept of embracing the complexities of classrooms permeated the entire reading methods course (Roehler, 1992).

In short, the teacher candidates were helped to act like they knew what they were doing, and to continue to learn until they actually did (Roehler, 1992). Rogoff, (1990) summed it up nicely when she stated that learners need to be supported as they function at the edge of their competence while on the edge of incompetence.

The teacher candidates were actively involved in oral and written learning conversations throughout the semester-long course. All teacher candidates wrote in their journals after each course session and field session. As partners, they responded in written and oral form to each others' journals at least once a week. Each class session included small-group discussions about course content, field experiences, and other relevant information. The teacher candidates used RCE as part of the teaching and learning process while developing their knowledge, skills and strategies, and dispositions about the teaching and learning of reading, writing, and oral discourse.

Using RCE

The pre-service teachers were divided into eight groups of four partners each for the last half of the semester course. Partner and small-group conversations were expanded to include RCE as a learning tool, with the discussion forum becoming an integral par of the course's literacy activities. The partner teams viewed clips together, after which each individual selected five RCE clips that they thought illustrated optimum learning opportunities for elementary school students. Each group of four posted their twenty selections (four group members, each having five clips) on the Forum, accompanied by a rationale for the inclusion of each clip. Each group of four winnowed (via conversations on the Forum) the set of twenty clips down to the ten best examples of student learning, and then wrote electronic or hard copy papers explaining and defending their choices. These papers, written individually or collectively, became required artifacts in participants' growth portfolios. At the end of the study, over 230 responses had been posted on the Forum.

Data Analysis

The learning conversations from the Forum were analyzed using both qualitative (constant comparison analysis [Glaser & Strauss, 1967]) and quantitative (correlation analysis) tools. Inter-rater reliability between two of the researchers was established at 97%. For the qualitative method, the Forum interaction transcripts were read and reread to capture the flow of conversations. Patterns that signaled surface and or deep understandings of optimum learning opportunities were noted and compiled. Once categorized, these patterns were used to predict the frequency of optimum learning opportunities, as found in the final papers written by students in the course. We wanted to know whether the depth of understanding that surfaced in the discussions was reflected in independent indices of student learning.

Results and Discussion

Two potentially independent lenses emerged from our qualitative analysis of the electronic conversations: intertextuality—the degree to which responses mentioned multiple texts, experiences, and examples, (no mention versus some mention)—and level of engagement (reiteration versus justification of response). Each of the student groups' electronic responses fell into one of four categories: reiteration with no intertextuality, reiteration with some intertextuality, justification with no intertextuality, and justification with some intertextuality.

Intertextuality

Many of the responses reflected a simple discussion of the clip itself, with no connection to similar situations. Others, however, broadened the discussion to include such elements as the text used in the clip; past, present, or future personal experiences; references to collaborating teachers and their teaching materials; ideas learned in this and other courses; and responses to the work of colleagues in the course. This type of conversation reflected what we considered to be higher-order thinking, because of the complex connections involved in the response (Hartman, 1995). In order for a unit of conversation to be considered "intertextual," at least one of these features had to be present.

Level of Engagement

This dimension reflected the amount of engagement with the ideas in the clip, specifically in relation to teaching and learning. At the lower end, responses simply reiterated what happened in the clips, with no rationale for selecting a particular clip. Such responses offered no explanation as to why the clip illustrated something important about teaching and learning. Conversely, high-end responses demonstrated a deeper understanding by considering and explicating the relationship between the clip and the teaching or learning process.

By comparing the levels of these dynamics, we sorted conversations into one of four categories. Listed below is a summary and example of each type of response.

Low on engagement and low on intertextuality (LELI). There was nothing in the response beyond mere reiteration, and no attempt to link the clip to any ideas associated with teaching and learning. "[We] feel that the teacher had a very good idea to have the children bring in items or pictures of items that began with the letter of the week."

High on engagement and low on intertextuality (HELI). The clip content was reiterated but the response displayed evidence of a deeper understanding of the connection between the clip and teaching and learning. "Teaching story grammar can allow the students to write their own story with a plot and a point of view which will help make sense to the reader. Teaching grammar may also help develop a story that is more enjoyable and comprehendible [sic]."

Low on engagement and high on intertextuality (LEHI). Such responses revealed relationships to other texts and ideas, but provided no explanation of what the clip revealed about teaching or learning. "I think this is a great program she has set up, what do you think teachers might be able to use in older grade[s] to help with their child[']s learning?"

High on engagement and high on intertextuality (HEHI). The final category was a response high on both scales—it linked to other

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> texts or ideas and its link to teaching or learning was well articulated. "This clips [sic] shows teachers teaching kids for thinking outside the classroom. So many times teachers are asked 'when am I ever going to use calculus in the real world?' My teachers always told me that it isn't the calculus but the thinking process that I will develop from learning calculus. In this clip kids are taught to always be thinking. I enjoyed this clip and hope to teach thinking skills in my students in the future."

After creating this rubric, two graders independently scored the Forum responses, achieving 98% inter-judge agreement.

Table 1 presents the proportion of responses for each group across the four categories. It also includes the overall score for the group paper. One immediately notices that the *total number* of responses posted on the forum seems to have little relationship to the *type* of response posted. Thus, although Group Two only posted to the forum 12 times, they achieved a greater proportion of high engagement and high intertextuality ratings and a greater final overall paper score than did Group Eight, which posted 40 times. These data suggested that type of response was likely to prove a better predictor of paper scores than was the number of responses.

Table 1: Types and percentages of responses in the forum

Group	#Overall Score	% of LELI Responses	% of HELI Responses	% of LEHI Responses	% of HEHI Responses	Total # of Responses
1	3.61	.04	.41	.01	.53	68
2	2.64	.08	.42	.17	.33	12
3	2.10	.14	.52	.00	.34	29
4	2.16	.38	.08	.23	.31	13
5	1.85	.09	.48	.09	.33	33
6	1.50	.00	.71	.14	.14	7
7	1.44	.80	.15	.05	.00	40
8	.69	.78	.22	.00	.00	18

LELI—Low engagement, low intertextuality
HELI—High engagement, low intertextuality
LEHI—Low engagement, high intertextuality
HEHI—High engagement, high intertextuality

The overall paper score was obtained by averaging two numbers. First, the papers were evaluated on the basis of their completion of the assignment. Students had been instructed to write a paper summarizing the clips they had chosen, and explaining why they chose them and what they had learned in relation to literacy instruction. They were also advised that organization of the paper would be a criterion. The combination of these two factors resulted in the overall "paper grade."

However, as with the electronic conversations, we were interested in the ways in which students used their papers to relate to other texts or ideas outside of RCE (intertextuality), and the extent of their emphasis on the relationship of the clips to teaching and learning (engagement). Thus, we assigned both an engagement and intertextuality scores. It is important to

note that while these ratings were unrelated to student conversations, similar criteria were used to scale intertextuality and engagement.

The final overall paper score was an average of the initial paper rating and the score from the second analysis. We immediately noticed that the types of forum responses seemed to say a lot about the score that a group would receive on the overall paper grade. So we ran a correlation, focusing on the relationship between the overall paper score and those responses that demonstrated both high engagement and high intertextuality.

There was a significant correlation (see Table 2) between overall paper score and the number of group discussion forum postings that reflected high engagement and high intertextuality ratings ($p<.01$). This suggested to us that groups who utilized the discussion forum with high levels of engagement and intertextuality were scaffolded in the development of richer thinking skills. The most plausible explanation of this effect is that the discussion forum created an opportunity to internalize thoughts on what it meant to be a teacher. It gave students the chance to talk and think about the type of teacher each was becoming.

Table 2: Correlations between overall paper score and responses with differing levels of engagement and intertextuality

	Overall	Low on both	High engagement	High intertextuality	High on both
Overall Pearson Correlation	1.000	-.637	1.50	.105	.909**
Sig. (2-tailed)		.090	.723	.804	.002
N	8	8	8	8	8

In order to demonstrate this point more vividly, we selected two sets of responses from two different groups of pre-service teachers. Many students decided to post comments individually, even though they were working in groups. Thus, one set of responses might elicit three or four comments from the other members of the group. Other groups, however, as in the example below, chose to work in pairs. The first set of paired responses received a low rating on both the engagement and intertextuality scales. Notice that both responses are mere summaries of the clips. Statements are made, but there is little or no justification for why these clips are important. Neither is there any connection to ideas or experiences outside the clips.

> Initiator 1: This field trip incorporated the whole language approach to literacy. The children were able to search for the ba-ba-ba-barley (phonics) and were able to relate this reading activity with practical applications to life.
>
> Response 1: We also chose this as one of our ten important clips. We felt that connecting every day activities is important to motivate students' learning. We think we should definitely use this clip.

In comparison, the following set of individual responses received high ratings on both scales. They revealed many assertions, elaborations, and connections to teaching and learning, and they included links to things outside of the clip, such as the students in the movie, colleagues' notes to the forum, and thoughts about school-home connections.[1]

> Initiator 1: I think this is a great opportunity for learning. So many things are happening in respect to learning during this activity. First, by assigning recreational reading for homework, literacy is reinforced at home. There are some children that do not have the luxury of having books of their own at home. This encourages the children to increase their desire to read outside of the classroom. Second, the book conference encourages point of view. The children are given the opportunity to talk about their book from their point of view. It gives them a sort of ownership over their reading. Lastly, it underlying develops positive attitudes about reading. Not only do the children get to read a book that they chose, but they get to tell someone about the parts that they enjoyed the most. It seems like it would really empower the student in terms of literacy.
>
> Response 1: I agree, this form of teaching also helps the students see a new point of view as well as get more information if their was something that they didn't understand.
>
> Response 2: Book conferences give students the feeling of accomplishment and give them a sense of pride from their reading. I do think this is a great opportunity, because like you said it gives the students to take a book home with them and read outside of the school environment. Also, anything that is going to build up the self-esteem or positive image of literacy for these children is extremely important and should not be ignored.

As evident from the differences in the two sets of responses above, different teacher candidates utilized the forum in different ways. Some chose to elaborate and justify their thoughts about what was important to them and how it related to teaching and learning. Others merely summarized what they had seen.

Implications

Even before undertaking this study, we knew about the benefits of social interaction and dialogue in learning experiences. Our study affirmed this claim by finding a high correlation between the utilization of a discourse forum to provide critical conversations and creation of a comparably complex and critical written product. However, utilization is an indexed response quality (high levels of engagement and intertextuality), not an overall quantity. The number of times that a person submitted a thoughtful posting (defined as containing both engagement and intertextuality) was the best predictor of paper quality.

We are not sure why some pre-service teachers used the Forum in this positive way, while others used it merely to post summaries of clips. The question for future research on RCE, and any research related to the use of electronic discussion forums, is how to help learners use the environment,

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1. All text in the quotations has been copied verbatim from student work.

especially the Forum, in productive ways. We believe that the electronic discussion forum represents a unique opportunity for teaching and learning: one that retains many of the benefits of discourse and dialogue (the opportunity to socially interact) while offering the metalinguistic and meta-analytic advantages of print (Olson, 1994). In other words, learners are presented with a tool which enables them to share their thoughts and ideas informally.

Because these ideas are recorded, learners can also go back and review their own thoughts, or peruse and respond to the thoughts of others. In doing so, they develop patterns (habits) of careful thinking that may carry over into their teaching experiences, where they are more involved in ongoing assessment and monitoring of student learning. The ability to look back at their recorded responses may strengthen patterns and help them become metacognitively aware of their own patterns of thinking while their knowledge grows (i.e., they can appreciate what they already know and what they still need to learn).

One of our main research questions about RCE is whether it impacts the development of teaching and learning expertise when pre-service teachers move into the classroom for practicum, internship, or full-time teaching purposes. The present study was intended to gather evidence for one part of a larger question, about the impact of the social interaction generated by a tool like RCE on student thinking and writing. Our evidence suggests that RCE's electronic discussion forum affords learners numerous opportunities for posting, reflection, and the internalization of key ideas associated with a deeper understanding of teaching and learning.

These results suggest the value of a more discursively-based approach to technology and preserve teacher education. They not only have important implications for the development of educational technology and the literacy instruction of pre-service teachers, but also offer insight into the capability of technology-based tools to promote and support discourse and collaboration.

Future research should examine why different users utilize social Web-based tools (such as discussion forums) in various ways. If the evidence here suggests that successful electronic collaboration positively influences teacher candidates' learning about diversity and literacy instruction, then we need to determine how to scaffold that use more effectively. Future research should also expand the range of variables used as criteria for evaluating the applicability of RCE (and other electronic learning tools) to the goals of a particular course. The case of the Reading Classroom Explorer should include an examination of the goal of understanding literacy instruction and diversity, where diversity entails both pedagogical diversity and student diversity. Finally, more research is needed in order to examine the longitudinal effectiveness of tools such as RCE. This research should take the form of followup surveys on teaching beliefs and attitudes toward both pedagogical and student diversity, as well as observations of students in their initial teaching experiences. It would also include click-stream analyses of if, when, and how students returned to the Reading Classroom Explorer after their courses had ended, and especially after they had accepted full-time teaching positions. These studies would form the backdrop for classroom observations of teacher candidates' internship experiences. The goal of all of these studies would be to determine how RCE scaffolds—or provides opportunities for scaffolding—teacher candidates' growth toward becoming a teacher.

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